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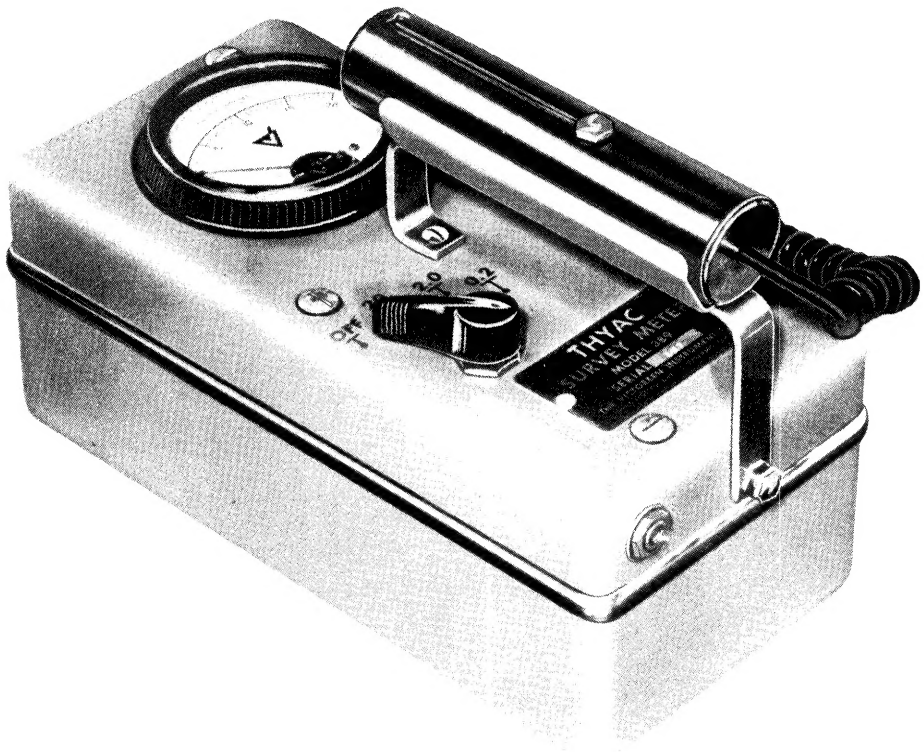
...instruction manual

THYAC
MODEL 389
AND 389A

The Victoreen Instrument Co.
5806 HOUGH AVE., CLEVELAND 3, OHIO

Victoreen



THYAC MODEL 389, 389A
DECEMBER 1950

THE VICTOREEN INSTRUMENT CO.
5806 HOUGH AVE., CLEVELAND 3, OHIO

WARRANTY

The Model 389 Thyac is guaranteed against defective workmanship and/or materials for six months from date of shipment.

Form 1001 (Part Number 389-111)

Litho in U.S.A. 5C

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SECTION 1
GENERAL DESCRIPTION

1. PURPOSE OF THE MODEL 389 THYAC.

The Model 389 Thyac is an instrument for the detection and semi-quantitative measurement of low intensity beta and gamma radiation. It is also capable of differentiating between beta and gamma radiation. The instrument is useful in the field or elsewhere, where a portable instrument with self-contained power source is required.

2. GENERAL DESCRIPTION.

The Model 389 Thyac weighs approximately five pounds and is housed in a laminated fiber-glass, splashproof case equipped with quarter turn fasteners for quick positive closure. Detection of radiation is accomplished by a Geiger tube mounted externally in a probe. On the top cover is a sturdy metal combination handle and probe clamp. Also mounted on the top cover is the range control switch and the indicating meter. On the end of the case is a waterproof jack for connection of the headset for aural monitoring.

Within the case the instrument's components are arranged for easy servicing and checking. The main battery is accessible, yet securely held in place in the bottom of the case with a snap-slide bracket. The vacuum tube amplifier, metering circuit, calibration controls, and filament battery are mounted on a single easily accessible panel. The hermitically-sealed, vibrator-type power supply is also contained within the case.

The vibrator power supply provides regulated high voltage for the counter tube and regulated plate voltage for the vacuum tube circuits. The supply is in a sealed metal case with mounting studs and turret-type terminals for easy mounting and connection to circuits in the instrument. Comprising the supply is a low-power vibrator, a transformer, rectifiers, filters, a corona-type voltage regulator tube, and a neon-glow regulator tube.

The waterproof indicating meter is calibrated in counts per minute and in milliroentgens per hour, based on radium gamma radiation, when used with the 1B85 counter tube.

The hand probe is a stainless steel shell with a perforated 360° window the full length of the sensitive area of the Geiger tube, and is connected by a coiled cable to the instrument case. The Model 389 Thyac is supplied with a type 1B85 aluminum counter tube, but other coaxial base counter tubes may be used. For example, low energy beta particles may be counted by substitution of the type 1B106, a counter tube with a thin mica window.

The probe shell is a shield, making it possible to discriminate against beta particles. The probe shield may be operated at will, by the thumb of the hand holding the probe.

3. REFERENCE DATA.

a. Nomenclature: Thyac, Model 389.
b. Range:
   (1) 800; 8,000; 80,000 counts per minute.
   (2) 0.2; 2.0; 20 milliroentgens per hour on radium.
c. Accuracy: Under field conditions p/m 10% of full scale indication.
d. Power input:
   (1) One 1.3 volt P.R. Mallory RM-4 cell.
   (2) One 4.5 volt Eveready No. 736 battery.
e. Weight: 5-1/2 pounds.
f. Overall dimensions:
   (1) Length 9-7/16 inches.
   (2) Width 4-11/16 inches.
   (3) Height 6-1/2 inches.
g. Electron tube complement: One 1B85, two 5828.
h. Functional description: Portable Beta Gamma Survey Meter.

SECTION 2
THEORY OF OPERATION

1. GENERAL.

Many elements such as Uranium, Radium, and Radon have radioactive properties, i.e. the ability to expel nuclear particles and rays. These emanations are of three types, namely Alpha particles, Beta particles, and Gamma rays. The Alpha radiation has a positive charge and ionizes gases very strongly but has very low penetrating power. The Beta particle has a negative charge and is actually a high speed electron. It will not ionize gases nearly as strongly as Alpha particles but has about 100 times greater penetrating power. The Gamma radiation is an electromagnetic wave and has no charge. It has the least ionizing power but the greatest penetrating power of the three. The ability of these radiations to ionize gases is the characteristic which is utilized to detect their presence.

2. THE COUNTER TUBE.

Referring to the circuit diagram, Figure 2-1, the detector tube, V-1, is a type 1B85 Thyrode thin wall aluminum counter, sensitive to Beta and Gamma radiation. Characteristics of this tube are shown in Figure 2-2. The Geiger counter tube consists of a fine anode wire mounted coaxially in a sealed cylinder which forms the cathode. This cylinder contains a mixture of an inert gas and an organic or halogen quenching vapor. A high voltage is applied between the cathode and the anode creating an intense electrostatic field in the tube. When a Beta or Gamma ray enters the sensitive volume of the 1B85 tube, it ionizes molecules of the gas or ejects electrons from the cathode which ionize the gas. The negative ions or electrons thus produced in the gas are accelerated toward the anode by the electrostatic field between the counter electrodes. The negative ions ionize more molecules of the gas by collision, and all find their way to the anode producing a negative pulse. An avalanche or rapid spread of ionization throughout the sensitive volume of the tube takes place.

At the same time the ionization also forms a positive ion sheath near the center electrode where the electrostatic field is the greatest. The electrostatic field strength in the sensitive volume of the tube is reduced by the positive ion sheath to the extent that the tube cannot sustain the ionization process. The energy of the positive ions is absorbed by the quench vapor and the tube is ready for another sequence of operation.

3. RATEMETER CIRCUIT.

(Refer to schematic diagram Figure 2-1, page 2-3.)

The Thyac circuit, composed of tubes V-2 and V-3, is a cathode coupled monostable multivibrator, sensitive to negative pulses. This multivibrator functions as an amplitude discriminator and pulse shaping circuit, providing uniform pulses of current which are averaged and measured on a sensitive meter. The meter reading is proportional to the average rate of pulse occurrence in the Geiger tube. Also included is a low impedance output to drive a headset for an audible indication of the pulse rate.

Two filament type 5828 high-mu triodes, V-2 and V-3, are used in the circuit. Characteristics of the 5828 triode are shown in Figure 2-3. During the no signal periods V-2 is biased to give a plate current of approximately 150 microamperes. Vacuum tube V-3 is biased beyond cutoff by the IR drop across the common cathode resistor R-6. Thus no plate current flows in V-3, and the meter M-1 rests at zero. The grid return for V-3 is through R-7, R-8, and the germanium diode CR-1.

When the 1B85 counter tube is pulsed by radiation, the electrons collected on the anode discharge through resistor R-4. This produces a negative voltage pulse that is applied to the grid of V-2, through coupling capacitor C-1. The pulse is amplified and inverted by V-2 giving a positive pulse at its plate. The positive pulse is coupled by one of the timing capacitors C-2, C-3, or C-4 to the grid of V-3 driving it to conduction if the pulse is of sufficient amplitude. The current flowing through V-3 causes the cathode voltage to rise (voltage drop across R-6), further decreasing the current through V-2 and increasing the voltage pulse at the grid of V-3. This feedback action continues rapidly until V-2 is cutoff by the current through V-3. The current through V-3, approximately

500 microamperes peak, charges integrating capacitor C-5.

The counter tube, V-1, completes its discharge during the triggering of the circuit and begins to recover. The current flowing in V-3 decays exponentially as the timing condenser C-2 charges through R-7, R-8, and the high back resistance of CR-1. This decreases the drop across R-6 finally allowing V-2 to draw current. The plate voltage on V-2 then drops, decreasing the grid of V-3 further and driving the circuit back to the original condition of V-2 conducting and V-3 cutoff. As soon as the timing capacitors C-2, C-3, or C-4 and bypass capacitor C-7 discharge back to their original voltages the circuit is again ready to receive a pulse from the counter tube.

Because of the random nature of radiation it is paramount that the total effective dead time be kept to a minimum. As the recovery time is reduced, the linearity of the instrument is improved because the instrument cannot register pulses during recovery intervals. In the Model 389 Thyac excellent recovery characteristics are obtained by incorporating a germanium diode (CR-1) and the bypass capacitor C-7. During the increment of time between the instant of the initial pulse and the time when V-3 begins to conduct, the germanium diode (CR-1) presents a low impedance path so that the capacitor C-7 bypasses the common cathode resistor R-6, resulting in greater voltage gain and higher circuit sensitivity. When V-3 conducts, a positive pulse results in the cathode circuit; thus the common cathode resistor is no longer bypassed as the germanium diode offers a very high impedance with the reversed polarity. Also the apparent V-3 grid circuit resistance is raised by the high impedance of the germanium diode with this polarity. When the circuit returns to the normal condition the capacitors discharge through the germanium diode in the low impedance direction. This circuit gives the Model 389 Thyac the desired dead time characteristics.

4. METERING.

The meter M-1 is calibrated so that the instrument reads directly in counts per minute. During the pulse periods the plate current of V-3 (approximately 500 microamperes) charges capacitor C-5. The individual pulses are integrated by the discharge of capacitor C-5 through the meter and resistance R-3. The time constant of this combination is made up of the natural time constant of the meter and (R-meter + R-3) x C-5. The actual time constant of the Thyac, or time for the meter to reach .67 of the final reading, will be 3 to 5.5 seconds with a nominal value of 4 seconds. When the time constant of the metering circuit is large compared to the interval between pulses, the meter shows an average reading of the pulse repetition rate. However, variations will occur in the metering with long intervals between pulses. These variations are caused by the random occurrence of the particles being measured. The result is a statistical variation in the pulse repetition rate. The magnitude of the random variation is inversely proportional to the square root of the average pulse repetition rate and inversely proportional to the time constant of the circuit.

5. SWITCHING.

All switching functions in the Model 389 Thyac are accomplished by the switch S-1, operated by knob E-5. In the "OFF" position all of the batteries are disconnected from the circuit. As the switch is advanced clockwise the ranges 80,000, 8,000, and 800 counts per minute are energized in succession. Ranging is accomplished by connecting capacitors C-4, C-3, or C-2 respectively into the circuit to provide control over the length of time V-3 is conducting during each pulse, controlling the average current flowing through meter M-1.

6. AURAL MONITORING CIRCUIT.

A reasonable audio output for aural monitoring is accomplished with a minimum of loading of the circuit by connecting the earphone across the common cathode resistor R-6. Capacitor C-6 functions as a coupling capacitor and R-9 as a current limiting resistance.

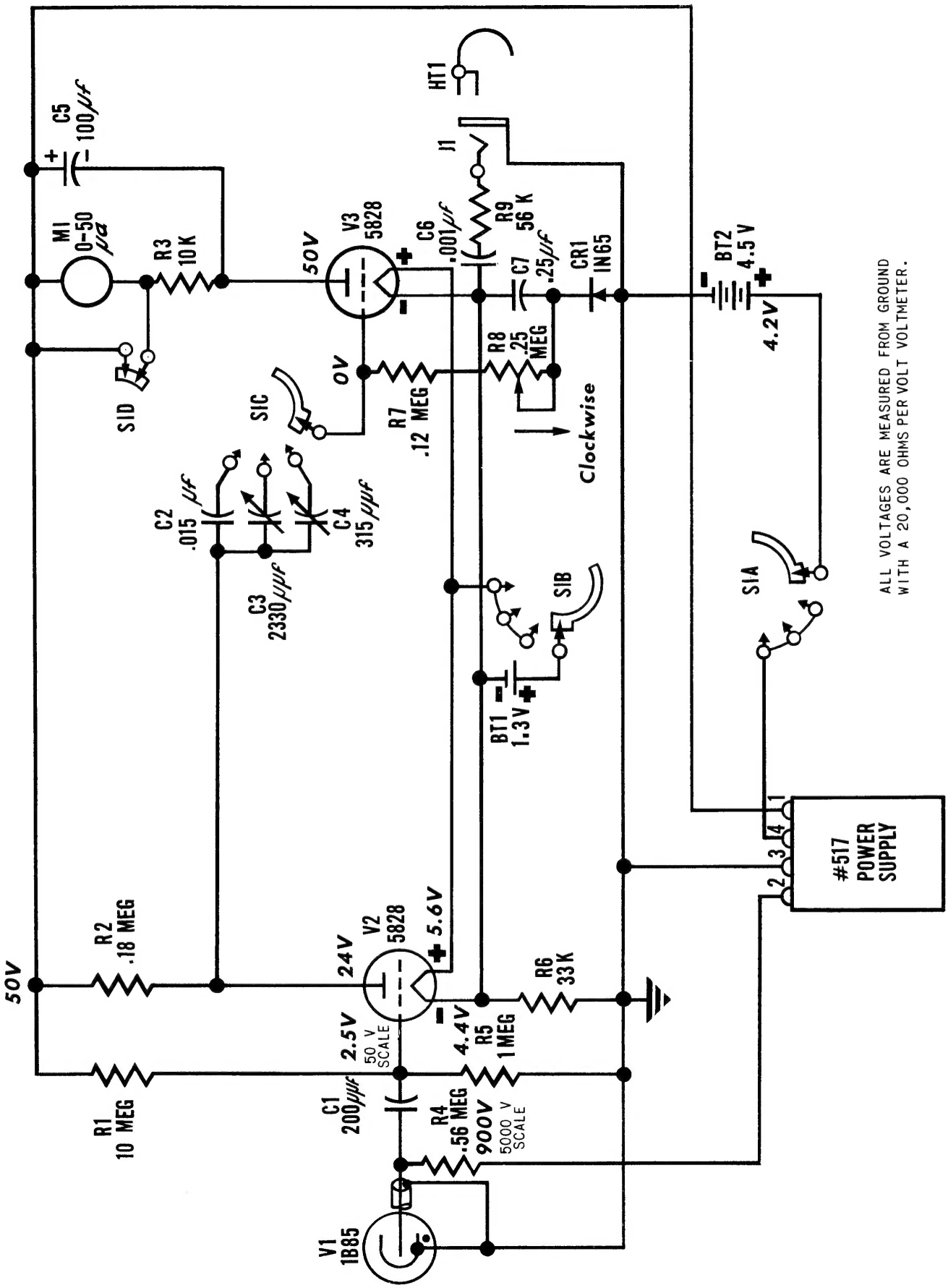
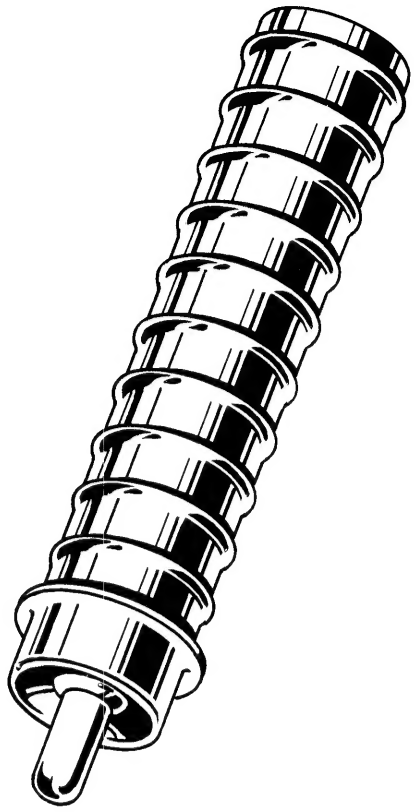


Figure 2-1 SCHEMATIC WIRING DIAGRAM

CHARACTERISTICS

THRESHOLD VOLTAGE*.....	(MAX) 800	VOLTS
PLATEAU LENGTH*.....	(MIN) 200	VOLTS
PLATEAU SLOPE*.....	(MAX) 3	%/100 VOLTS
(V_0=800 TO 1000 V)		
RECOVERY TIME.....	100	μSEC
BACKGROUND.....	40	C/M
(V_0=900 V)		
LIFE.....	10^9	COUNTS
(AT 6000 C/M, V_0=900 V)		
LIFE TEST END POINT, SLOPE.....	10	%/100 VOLTS
(V_0=850 TO 950 V)		
ACTIVE LENGTH.....	2.75	INCHES
WALL (ALUMINUM).....	30	MG/CM^2
ELECTRODE CAPACITANCE.....	2	$\mu\mu f$

*NEW TUBES



RATINGS

OPERATING VOLTAGE.....	(MIN)	850	VOLTS
	(MAX)	950	VOLTS
AMBIENT TEMPERATURE.....	(MIN)	-10 °	C
	(MAX)	100 °.	C
RELATIVE HUMIDITY.....	(MAX)	100	%

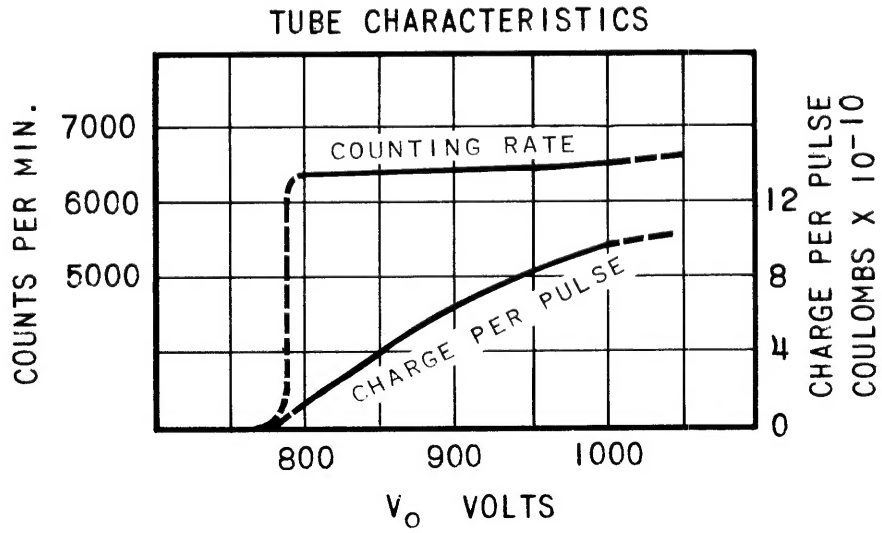


Figure 2-2 1B85 TUBE CHARACTERISTICS

CHARACTERISTICS

FILAMENT VOLTAGE (AC-DC)	1.25	VOLTS
FILAMENT CURRENT	10	MA
DIRECT INTERELECTRODE CAPACITANCES		
GRID TO PLATE	2	μμf
GRID TO FILAMENT	2	μμf
PLATE TO FILAMENT	1.5	μμf

TYPICAL OPERATION
(AS DC AMPLIFIER)

PLATE VOLTAGE	45	VOLTS
GRID VOLTAGE	-1.0	VOLTS
AMPLIFICATION FACTOR	17.5	
TRANSCONDUCTANCE	450	μMHOS
PLATE CURRENT (ZERO SIGNAL CONDITION)	250	μA
GRID CURRENT (APPROX.)	10^{-9}	AMP.

MAXIMUM RATINGS

FILAMENT VOLTAGE	1.5	VOLTS
PLATE TO FILAMENT VOLTAGE	100	VOLTS
AVERAGE CATHODE CURRENT	500	μA

PLATE CHARACTERISTICS

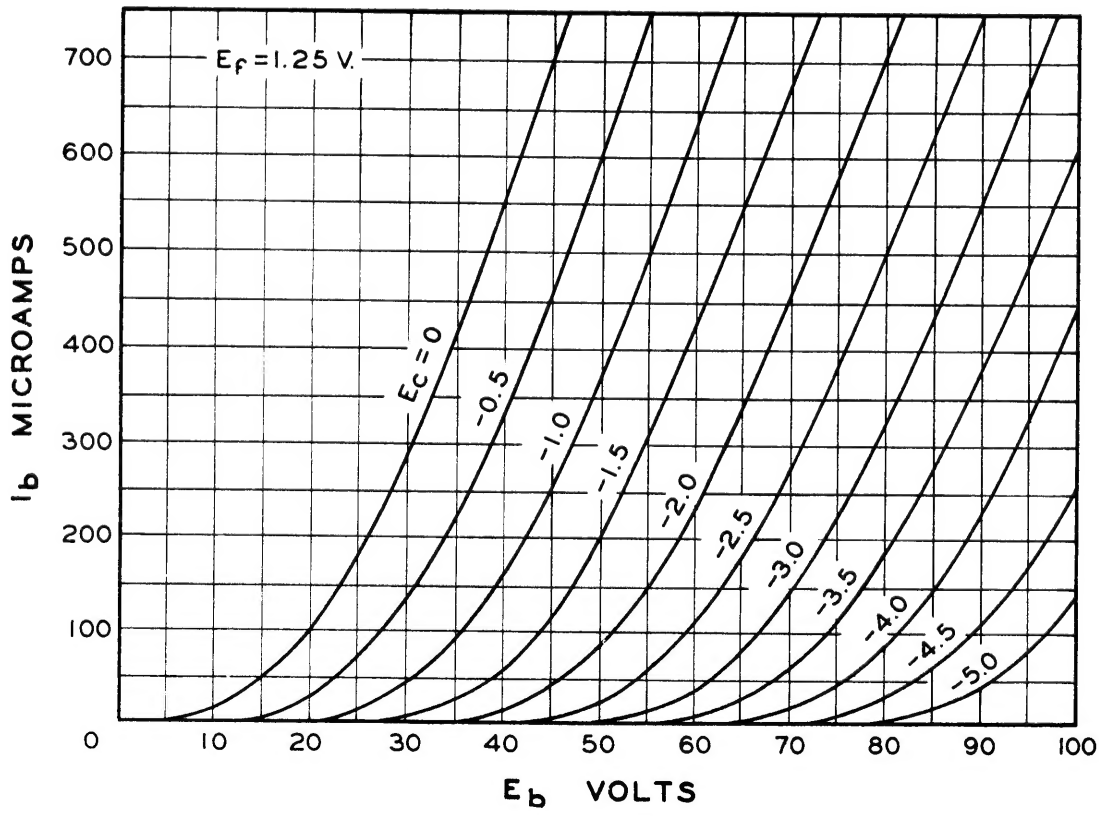


Figure 2-3 5828 TUBE CHARACTERISTICS

7. VIBRATOR POWER SUPPLY.

(See illustration below.)

The Model 517 Vibrator Power Supply used in the Model 389 Thyac utilizes a non-synchronous vibrator. The supply operates at very low power consumption with a series vibrator-transformer connection. The input is 4.5 volts and the output is 900 volts for operating the Geiger tube and 55 volts plate supply for the vacuum tube circuits. High voltage rectification is accomplished by a type 5517 cold-cathode gaseous rectifier in a half-wave circuit. A pi section filter is used and a type 5841 corona regulator and its associated resistor (R-3) regulate the output. The low voltage section utilizes a selenium rectifier in a half-wave circuit, a pi section filter, and a neon glow tube regulator with its associated resistor (R-5). Capacitor C-1 and resistor R-1 bypass the vibrator contacts and function as an arc suppressor.

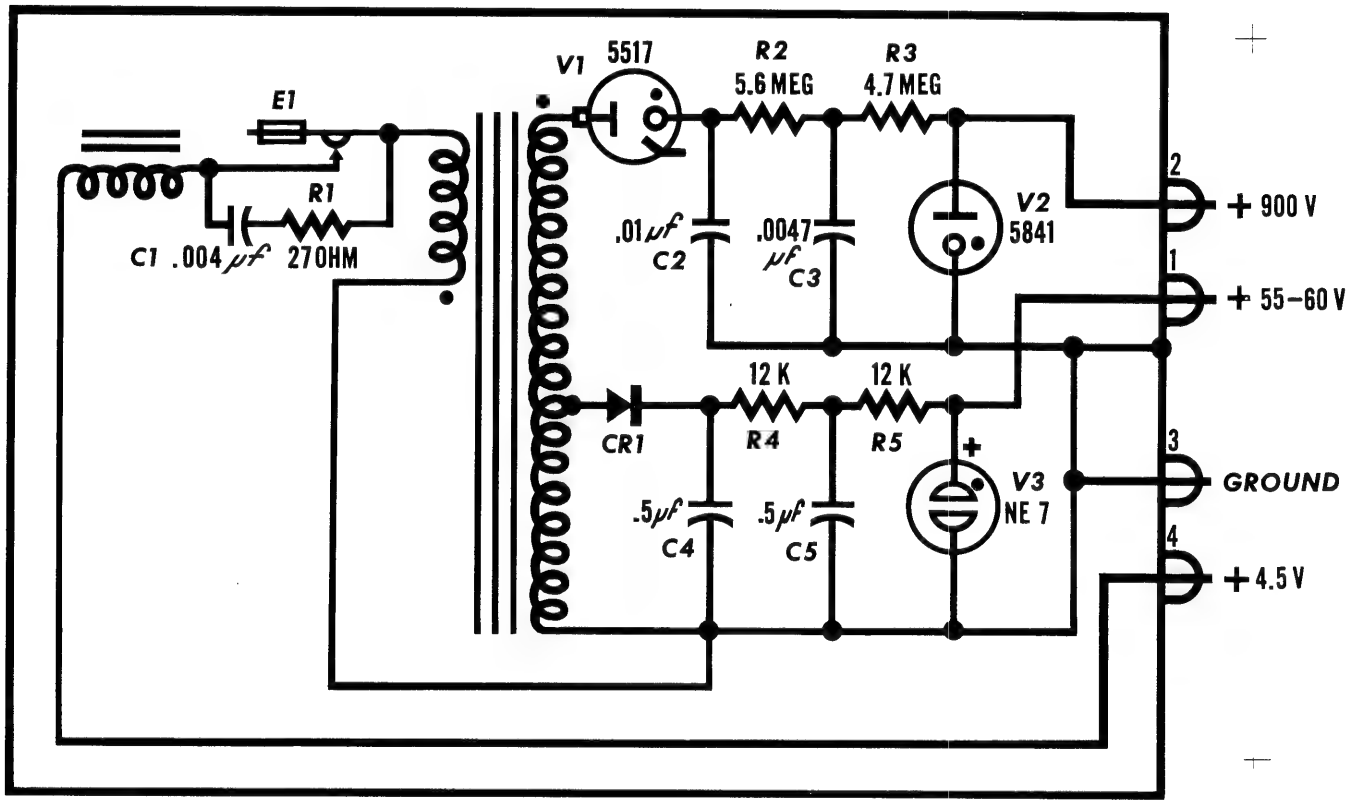


Figure 2-4 VIBRATOR POWER SUPPLY SCHEMATIC WIRING DIAGRAM

SECTION 3
OPERATION

NOTE: All symbol designations refer to the exploded view (Figure 4-2, Page 4-4.) and to the parts list in Section 5.

1. GENERAL.

If desired, the plastic strap (H-2) maybe fastened to the instrument by snapping the strap hooks over the stud on each end of the instrument case. The strap may now be adjusted to the desired length and placed over the shoulder.

If aural monitoring is desired the earphone provided is connected to the instrument by insertion of the phone plug into the jack (J-1). The adjustable head band may be fitted to suit the operator.

The probe may be removed from the combination clamp and handle, by lifting up on the probe against the spring action of the clamp. The coiled cable allows freedom, yet keeps out of the way.

2. GAMMA RAY MEASUREMENT.

1. Close the beta shield (E-2) on the probe.
2. Turn the range switch (E-5) to the 80,000 counts per minute range and wait several seconds for the instrument to warm up.
3. Place the probe in the location to be measured.
4. If the reading is less than 10% of the full scale, rotate the switch to the 8,000 counts per minute range.
5. If the reading is still less than 10% of the full scale, rotate the switch to the 800 counts per minute range.
6. Watch the meter (M-1) for about 30 seconds to determine the average reading. This is particularly important on the 800 counts per minute range.
7. Read the meter and correct for background if necessary, and record the data.

3. BETA RAY MEASUREMENT.

1. With probe shield closed perform the above gamma ray measurement steps "1" through "7".
2. Open the probe shield by operation of the button (H-10) and repeat the measurement.
3. Neglecting gamma absorption by the shield, the beta intensity is then the difference between readings "1" and "2".

4. BACKGROUND MEASUREMENT.

1. Turn the range switch to the 800 counts per minute range. The intensity is at or near background when the meter reading is less than 20% of full scale.
2. Plug the earphone into the jack (J-1) on the front of the case and adjust head band for comfort.
3. While observing a stop watch or other watch with a sweep-second-hand, count the number of clicks in the earphone for a one minute time interval.
4. Repeat step 3 several times allowing a rest period between counts.
5. Average the one minute background readings to obtain the results in counts per minute.

5. RADIUM MEASUREMENTS.

Roentgen rate measurements on radium may be read directly (using the 1B85 counter tube) on the red scale of the meter. Calibration will be correct for radium radiation filtered by 0.5 mm platinum, under which condition the ranges are 20, 2.0, and 0.2 milliroentgens per hour.

From the chart in Figure 3-1 it will be seen that the minimum energy dependence is obtained with the probe shield open. Thyac roentgen calibration has therefore been made with the shield open, and assumes no beta radiation is present. If the shield is used closed to exclude beta particles in a mixed beta-gamma field, then the instrument reading should be multiplied by 1.15 to obtain the correct gamma dose rate.

Approximate correction for other radiation energies may be found from Figure 3-1.

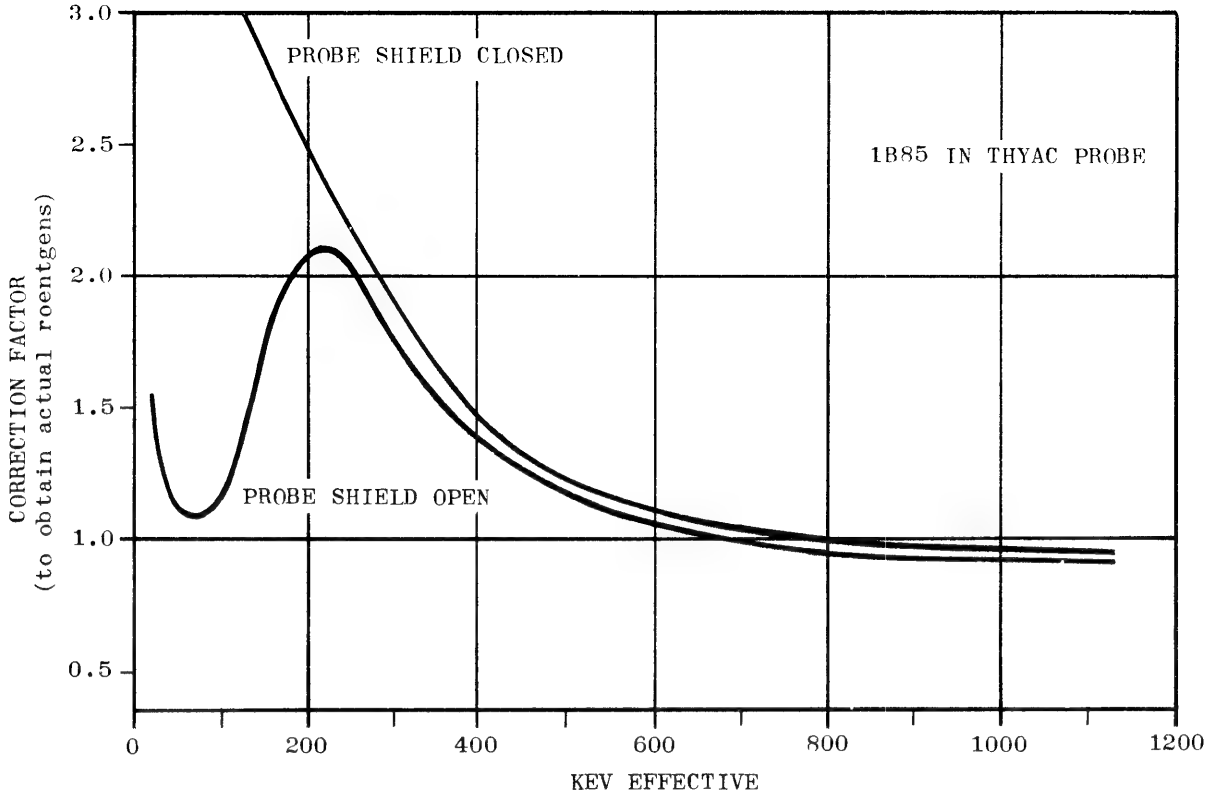


Figure 3-1 TYPICAL WAVELENGTH DEPENDENCE CHART

SECTION 4
MAINTENANCE

NOTE: Unless otherwise specified, all symbol designations refer to the exploded view (Figure 4-2. Page 4-4.) for identification, and to the parts list, Section 5, for description of the proper replacement parts.

1. GENERAL NOTE.

The mechanical design of the 389 Thyac permits easy servicing of the circuits and quick replacement of the batteries. The counter tube, protective grill, beta shield, and probe are all removable so that they may be cleaned or replaced in case of contamination. A hard, smooth finish on the instrument case facilitates decontamination.

2. BATTERY REPLACEMENT.

a. REPLACEMENT OF THE 4.5 VOLT BATTERY.
1. Separate the sections of the case by turning the four Dzus fasteners a quarter turn counter-clockwise and lifting the cover off.
2. Remove the 4.5 voltbattery plug.
3. Unsnap the two snapslide fasteners holding the 4.5 volt battery in place.
4. Remove the battery bracket.
5. Remove the old battery.
6. Insert the fresh battery.
7. Set battery bracket in place.
8. Snap snapslide fasteners into position.
9. Press battery plug into position.
10. Replace cover and fasten Dzus fasteners.

b. REPLACEMENT OF THE 1.3 VOLT BATTERY.
1. Separate the sections of the case by turning the four Dzus fasteners counter-clockwise and lifting off the top.
2. Lay the top section of the case on its side.
3. Unsnap the clamp holding the 1.3 volt battery in place.
4. Remove the 1.3 volt battery. (Observe polarity)
5. Insert the fresh battery.

6. Lock the battery clamp.
7. Reassemble.

3. PROCEDURE FOR CHECKING THE 1B85 COUNTER TUBE.

1. Make sure that the batteries are satisfactory, and the correct voltage is impressed across the tube.
2. Place a source of beta or gamma radiation at the proper distance to yield a meter reading of 40,000 counts per minute.
3. Connect a 10 megohm resistor in parallel with the counter tube so as to reduce the tube operating voltage to 850 volts. If a 10 megohm resistor is not available, a 45 volt battery connected series bucking will produce the same effect.
4. If the meter reading decreases below 36,000 counts per minute replace the 1B85 counter tube.

4. REPLACEMENT OF THE COUNTER TUBE.

1. Remove the probe from the instrument handle.
2. Slide the shield open and turn the latch button into the enlarged notch.
3. Unscrew the latch button.
4. Slide the shield off the probe.
5. Unscrew the perforated guard from the base section.
6. Remove the friction sleeve by slipping off of the end of the base section.
7. Hold the guard in the left hand. Grasp the metal contact of the counter tube with the fingers of the right hand, and while wiggling back and forth, pull the tube free. With the base section unscrewed the tube is held by a rubber gasket, and the wiggling may be necessary to pull the tube free.
8. Remove the rubber gasket from the old tube.
9. Slip the gasket over the base of the new tube.
10. Carefully wipe the glass on the bottom of the tube free of finger prints with a clean dry cloth.
11. Insert the tube in the base section of the probe.
12. Replace the friction sleeve.
13. Screw the guard onto the base section.
14. Slide the shield into place with the enlarged locking notch to the free end (away from the cable).
15. Replace the locking latch button.

5. CALIBRATION.

The Model 389 Thyac is calibrated by exposing it to radium gamma radiation from a known source and adjusting the CAL adjustment and trimmer capacitors. Calibration is best performed in an open space, with no nearby metal objects, and with the instrument and radium source supported on a wooden or other non-metallic bench.

1. To calibrate, place a one milligram (mg) standard radium source 240 centimeters (cm) from the center of the probe. Remove top cover of instrument.
2. Open the beta shield.
3. If other than a 1 mg source is available, correct the distance figures by the use of the following equation.

$$\frac{1}{x} = \frac{d^2}{D^2}$$

Where:

x is the mass.
d is the known distance.
D is the unknown distance.

4. Turn the range switch (S-1) to the 800 counts per minute range and allow the instrument to warm up.
5. Adjust the CAL control (R-8) until the meter reads 600.
6. Turn range switch to 8,000 counts per minute range.
7. Place the 1 mg radium source 75 cm from the center of the probe.
8. Adjust the trimmer capacitor C-3 until meter M-1 reads 6,000 counts per minute.
9. Turn the range switch to the 80,000 counts per minute range.
10. Place the 1 mg radium source 24 cm from the center of the probe.
11. Adjust trimmer capacitor C-4 until meter M-1 reads 60,000 counts per minute.

6. TROUBLE SHOOTING NOTES.

Detection of faults and replacement of defective electronic components is accomplished by conventional procedures.

It must be kept in mind that it is imperative to recalibrate the instrument after replacement of any components except batteries.

A schematic diagram is included in this manual, Figure 2-1 on page 2-3 . Note that voltages at key points are marked on this diagram. Voltage readings should

be made with a voltmeter having a minimum of 20,000 ohms per volt internal resistance.

The Model 517 Vibrator Power Supply is potted and sealed for more reliable operation; therefore field repairs to the power supply are impractical. Return the unit to the manufacturer for repair or replacement.

A chart of symptoms and possible sources of trouble is included in this manual. See illustration below.

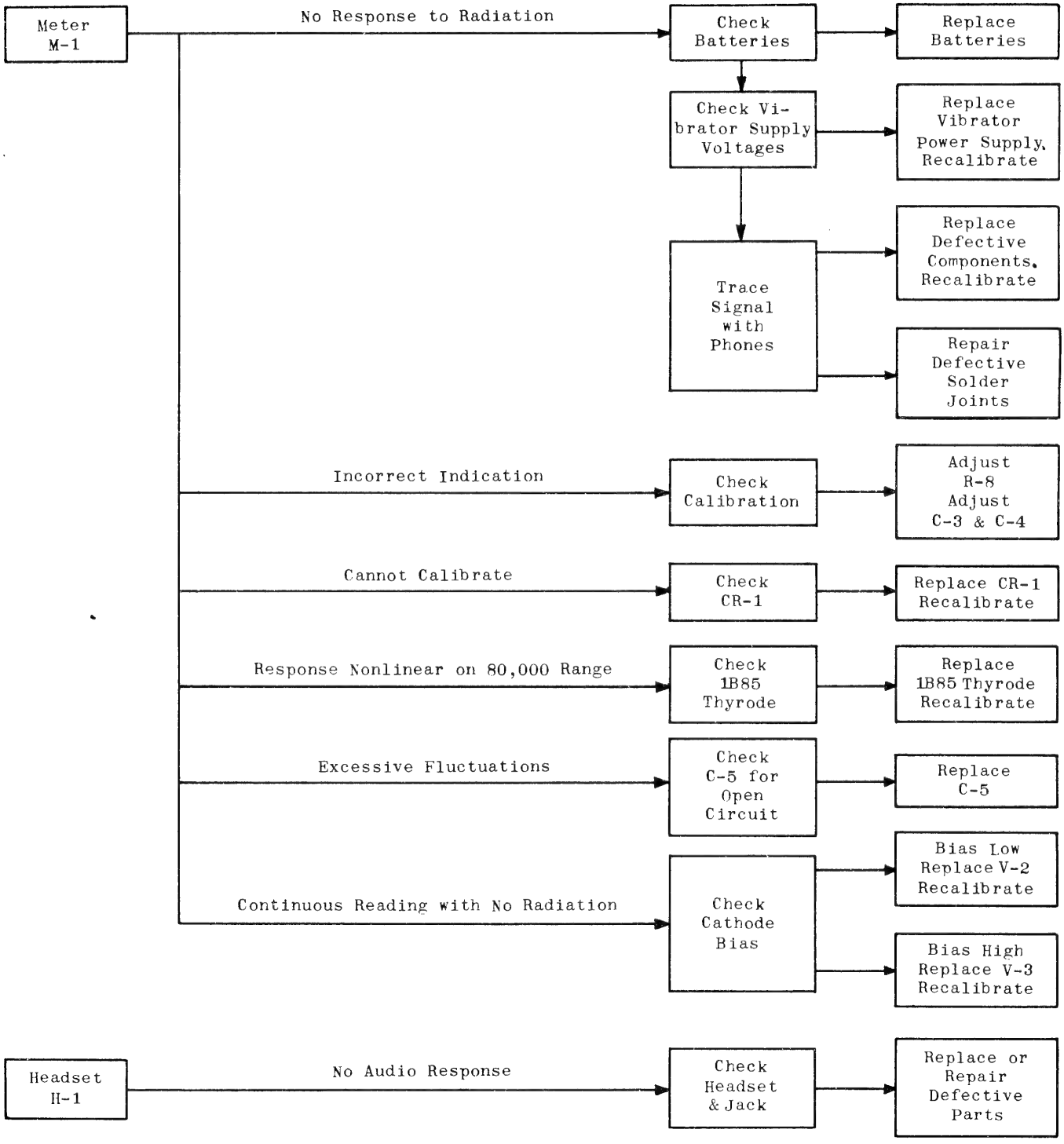


Figure 4-1 TROUBLE SHOOTING CHART

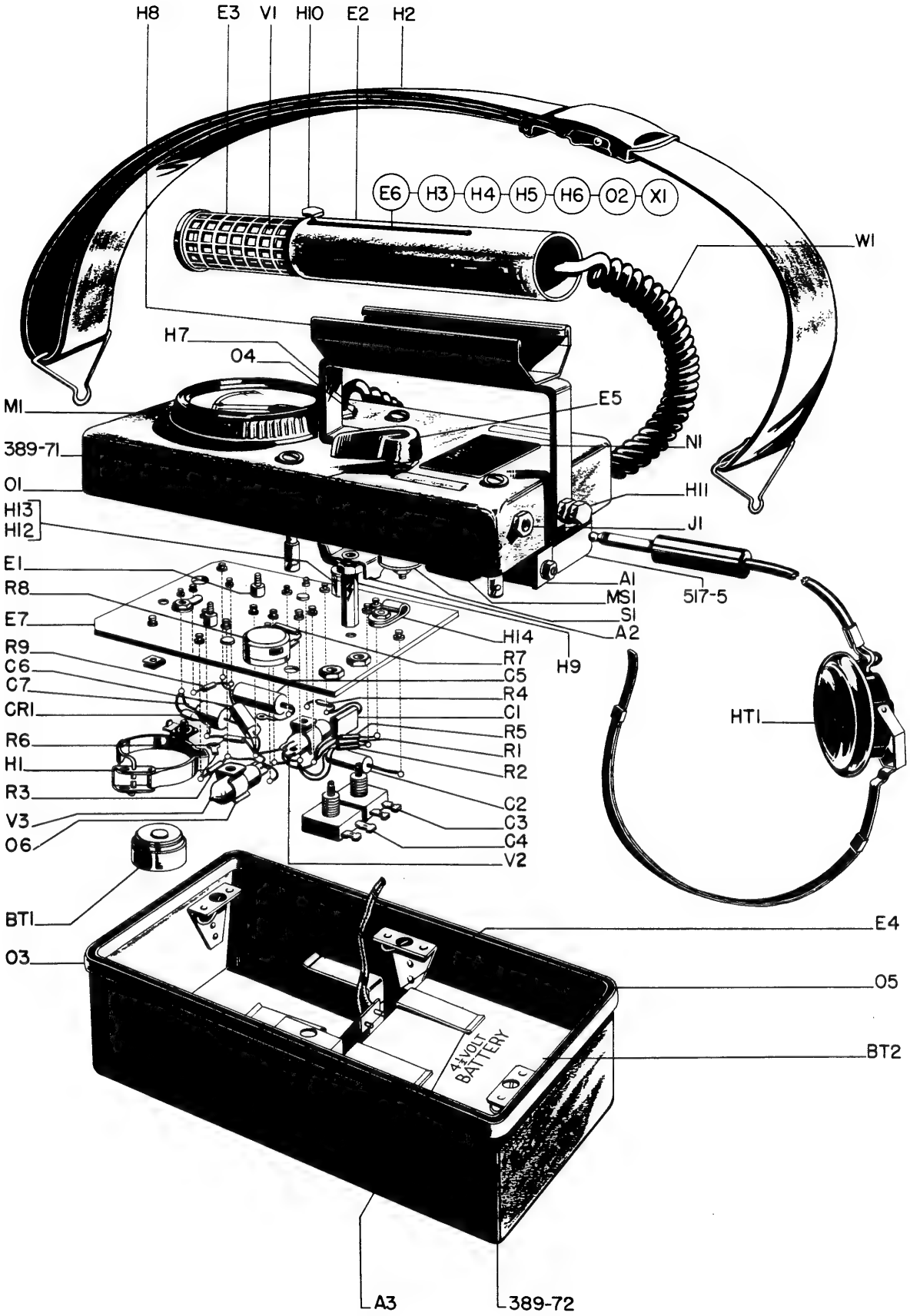


Figure 4-2 REFERENCED ILLUSTRATION

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORPS) STOCK NO.	MFGR. AND MFGR.'S DESIG.	VICTOREEN PART NUMBER	ALL SYMBOL DESIG. INV.	QTY. PER EQPT.	ITEM NO.
---	CASE: gray laminated fiber glass matte, grade GF, smooth finish; .075"thk; 9-1/4"lg x 4-5/16"w x 2-7/16"d o/a; has three 1-1/4"lg x 3/16"w x 1/16" h projections which serve as feet; has four "L" shaped brackets 1"lg x 1-1/8"w x 5/8" d o/a riveted to case sides; flat "S" shaped Dzus spring mtd on "L" shaped brackets; one bracket 3-5/16"lg x 9/16"w x .0508"thk riveted to bottom for battery support bracket.	Bottom section of instrument case.			Victoreen Inst. Co. 389-72	389-72	---	1	1
---	CASE: gray laminated fiber glass matte, grade GF, smooth finish; .075"thk; 9-1/4"lg x 4-5/16"w x 1-5/16"d o/a; has two 1-1/4"lg x 3/16"w x 1/16"d projections on top; four cadmium plated Dzus fasteners 2-3/16"lg x 7/16"diam o/a; mtd as captive fasteners through four 5/16"diam aluminum grommets and four rubber washers; No. 389-77 name plate (N1) mtd on top.	Top section of instrument case.			Victoreen Inst Co. 389-71	389-71	---	1	2

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORPS) STOCK NO.	MFGR. AND MFGR.'S DESIG.	VICTOREEN PART NUMBER	ALL SYMBOL DESIG. INV.	QTY. PER EQPT.	ITEM NO.
---	POWER SUPPLY: vibrator type; non-synchronous; high voltage output 900 v dc, 5 μa; plate voltage output 55 v, 250 μa; input 3.3 to 4.5 v dc, 44 ma; 3-13/32"lg x 2-1/4"w x 2-1/8"d o/a; half wave; built in filters and regulators; four No. 6-32 thd mtg studs each end; mtg studs on 1-5/8" & 1-3/4" mtg ctrs; four turret type terminals.	Supply high voltage and plate voltage to Thyac			Victoreen Inst Co. 517-5	517-5	---	1	3
A-1	BRACKET: No. 18 gage aluminum; roughly "J" shaped; 2-1/16" lg x 5/8"w x 1/2"d o/a; has two No. 23 drill holes on 1-5/8" ctrs, and in ctr of width one No. 18 drill hole in short leg 47/64" from bottom in ctr of width.	Rear Power supply bracket			Victoreen Inst Co. 389-60	389-60	A-1	1	4
A-2	BRACKET: No. 14 gage aluminum; "L" shaped; 2-1/16"lg x 5/8" w x 1-3/8"d o/a; two No. 23 drill holes on 1-5/8" ctrs and semi-circular notch of 1/2"r ctr 3/4" from base in upright section; one slot 3/16"w x 15/32" lg in base opposite upright section ctr 3/8" from edge.	Front Power supply bracket			Victoreen Inst. Co. 389-61	389-61	A-2	1	5

SYMBOL DESIG.	NAME OF PART AND DESCRIPTION	FUNCTION	JAN AND (NAVY TYPE) NO.	STANDARD NAVY AND (SIGNAL CORPS) STOCK NO.	MFGR. AND MFGR.'S DESIG.	VICTOREEN PART NUMBER	ALL SYMBOL DESIG. INV.	QTY. PER EQPT.	ITEM NO.
A-3	BRACKET: No. 18 gage CRS, cadmium plated; roughly "H" shaped; 4-1/2"lg x 2-13/16" w x 1-13/32"d o/a; two snapslides mtd on 1-3/16" ctrs; two clearance holes for snapslides studs 11/32" diam on 2-5/16" ctrs (cross leg of "H").	Battery clamping bracket assembly			Victoreen Inst Co. 389-81	389-81	A-3	1	6
C-1	CAPACITOR, fixed: mica; 200 μμf p/m 20%; 1000 v dc w; Temp. compensated; 25/32" max lg x 7/16" max h x 7/32" max d; two axial wire leads .032" diam x 1-1/8" lg.	Coupling capacitor			El-Menco VCM-20-B-201	389-28	C-1	1	7
C-2	CAPACITOR, fixed: paper; .015 μf p/m 20%; 200 v dc w; 1"lg x 5/16" diam; two axial wire leads 2"lg.	Coupling V-2 & V-3, 0.2 range			Sprague 67P15302	389-29	C-2	1	8
C-3	CAPACITOR, padding; 2330 μμf max; 15/16"lg x 7/8"w x 11/32"d excluding shaft and terms; slotted shaft 1/2"lg FMS; 1/4-28 mtg bushing 1/4"lg FMS, two solder lug terms.	Coupling V-2 & V-3, 20 range			El-Menco 312	389-65	C-3	1	9
C-4	CAPACITOR, padding; 85-315 μμf; 1-1/8"lg x 7/8"w x 27/32"d o/a; slotted shaft 1/2"lg FMS; 1/4-28 mtg bushing 7/32"lg FMS; two solder lug terms.	Coupling V-2 & V-3, 2.0 range			El-Menco 303	263-217	C-4	1	10

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C-5	CAPACITOR, fixed: dry electrolytic; 100 µf; 3 v dc w; 1-1/16 lg x 1/2" diam o/a; one axial wire lead 2-1/2"lg, one wire lead riveted to can 2-1/2"lg.	Meter bypass capacitor			Cornell Dubilier Type BBR	389-32	C-5	1	11
C-6	CAPACITOR, fixed: paper; .001 µf p/m 20%; 400 v dc w; 1" lg x 5/16" diam; two axial wire leads 2" lg.	Audio Coupling capacitor			Sprague 67P10204	389-31	C-6	1	12
C-7	CAPACITOR, fixed: paper; .25 µf +30 -20%; 200 v dc w; 5/8" lg x 15/32" diam; two axial wire leads 2" lg.	Bypass and feedback capacitor			Astron ML-2-25	389-30	C-7	1	13
E-1	INSULATOR, bushing: black laminated phenolic, grade X or XX; 1/4"lg x 1/4" OD x 5/32" ID.	Terminal board spacer			Victoreen Inst. Co. 389-39	389-39	E-1	2	14
E-2	SHIELD, tube: No. 16 gage stainless steel tubing, type 303; 1-1/4" OD x 1.120" ID x 5-1/8" lg o/a; has "L" shaped slot .093"w x 3"lg long leg and .093"w x 5/16"lg, flared to .150" diam, short leg.	Sliding shield for counter tube			Victoreen Inst. Co. 389-21	389-21	E-2	1	15
E-3	SHIELD ASSEMBLY, tube: No. 22 gage stainless steel type 302 grill; No. 11 gage stainless steel type 303 socket section; stainless braze; satin finish; 3-49/64"lg x 1.114" diam o/a; one 4-48 tapped hole 3-7/32" from grill end on center line of weld seam; 1"-20 inside thd	Tube shield assembly			Victoreen Inst. Co. 389-17	389-17	E-3	1	16

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	5/16" lg socket end.								
E-4	BOARD, terminal: laminated phenolic base 1/2"w x 1/16"thk x 1-1/8"lg; one 1/8" diam pin and one 5/32" diam pin 3/8"lg mtd on board on 23/32" ctrs.	4½ volt battery plug			Cinch Mfg Corp. No. 2792	389-74	E-4	2	17
E-5	KNOB: lever; black bakelite;for 1/4"diam shaft; single No.8-32 allen head set screw; 1-5/8"lg x 3/4"w x 5/8"h o/a; brass insert; shaft hole 7/16"d including ctb; straight serrations at lever extremity; 5/8" diam x 1/16"d projection concentric with shaft hole.	Actuate S-1			Harry Davies Mold No. 2110	263-107	E-5	1	18
E-6	BOARD, terminal: 1/16" thk, nylon filled laminated phenolic board formica grade YN-25 with one contact spring and one solder lug; 7/8"diam x 3/8"thk o/a; solder lug bent at rt angles to board; spring contact roughly "U" shaped.	Contact assembly for counter tube			Victoreen Inst. Co. 389-13	389-13	E-6	1	19
E-7	BOARD, terminal: 3/32"thk nylon filled, laminated phenolic board, formica grade YN-25; 5-1/2"lg x 3-15/16"w o/a; two corners chamfered 1/4"; 19 turret type terminal lugs and one contact spring & two fuse clips mtd on board in various positions; 13 other holes for component mtg.	Component mounting panel			Victoreen Inst. Co. 389-69	389-69	E-7	1	20

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H-1	CLAMP: .030" stainless steel; lever action lock; 1-1/4" across inside of clamp when locked; one mounting bracket with No. 8 diam hole and one positioning lug.	Secure BT-1 in place			Victoreen Inst. Co. 389-95	389-95	H-1	1	21
H-2	STRAP, carrying: .070"thk x 1-1/4"w polyvinyl chloride strip 42"lg with two delta shaped snaps .078" diam stainless steel wire 1-5/32"lg x 1-5/16"w inside strap loops; buckle for adj. strap length supplied.	Instrument carrying strap assembly			Victoreen Inst. Co. 389-84	389-84	H-2	1	22
H-3	WASHER, flat: 3/32" neoprene; 15/16" OD x 51/64" ID; 50 durometer p/m 5.	Counter tube seat seal			Victoreen Inst. Co. 380-6	380-6	H-3	1	23
H-4	NUT, packing: 18-8 type 303 stainless steel; hexagonal, 1-1/16" across flats, 1.114" diam across rounded head section; 1.114" OD x .191" ID x 17/64"lg o/a; head 3/32"lg x 1.114" diam o/a; neckdown 1/16" lg x 57/64" diam next to head; 15/16-32 thd 7/64"lg.	Probe cable clamping nut			Victoreen Inst. Co. 389-10	389-10	H-4	1	24
H-5	WASHER, flat: 1/8"thk rubber; 7/8" OD x 3/16" ID; 50 durometer.	Probe cable clamping washer			Victoreen Inst. Co. 389-11	389-11	H-5	2	25

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H-6	WASHER, flat: 1/8" thk nylon filled, laminated phenolic board formica grade YN-25; .875" OD x 3/16" ID.	Probe cable guide			Victoreen Inst. Co. 389-12	389-12	H-6	1	26
H-7	WASHER, flat: 1/32" black rubber; 1/2" OD x 3/8" ID; 75 durometer p/m 5.	Cable feed through gasket			Victoreen Inst. Co. 389-44	389-44	H-7	1	27
H-8	HANDLE: comprises handle and probe clamp spot welded together; case handle 1/8" stainless steel; probe clamp .025" stainless steel; roughly "U" shaped; 5-1/8"lg x 3-1/4"w x 1-3/8"d o/a; one No. 18 drill hole & one No. 18 drill ctsk. hole for mounting.	Case handle & probe clamp assembly			Victoreen Inst. Co. 389-58	389-58	H-8	1	28
H-9	POST, spacing: 24 ST aluminum hexagon shape; 15/16"lg x 1/4" w across flats; inside completely threaded with No. 8-32 thd.	Support terminal board			Victoreen Inst. Co. 389-38	389-38	H-9	1	29
H-10	BUTTON, slide: 18-8 stainless steel type 303; 7/16" diam x 5/16"lg o/a; hex hd 3/8" across flats x 3/32"lg; neck-down section .088"diam x 3/32" lg next to head; .135" diam x .030"lg raised section 3/32" from head; No. 4-48 thd 1/16" lg; undercut .082" diam x 1/32" lg.	Probe latch button			Victoreen Inst. Co. 389-22	389-22	H-10	1	30

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H-11	SCREW, machine: special hexagon head; stainless steel type 303 FM; 3/4"lg x 7/16"diam o/a; 3/8" head across flats 1/4"lg; with 15/32" spher. R. radial slot 3/32" wide x .164" diam 3/32" from head; No. 8-32 thd 5/16"lg.	Fasten carrying strap to instrument			Victoreen Inst. Co. 389-66	389-66	H-11	2	31
H-12	WASHER, molded: "O" ring; rubber; .070"thk x .176"ID x 5/16"OD.	Seal cable feed through			Linear Inc No. 1820-3	389-64	H-12	1	32
H-13	NUT, hexagon: 24 ST aluminum; 11/32"lg x 9/16"diam o/a; 1/2" across flats; .1935"diam cable hole 3/32"lg; 3/8"diam undercut 3/32"lg 5/32" from thd end; 3/8-32 inside thd 5/32" lg.	Cable clamping nut			Victoreen Inst. Co. 389-53	389-53	H-13	1	33
H-14	CLAMP: cable; 13/16"lg x 1/2"w x 3/8"d o/a; 1/4" loop one end .421" from mtg hole centerline; .199"diam mtg hole .218" from dip end; 1/32" clearance between clips leaves.	Hold instrument wiring in place			Commercial Plastics Co. CPC 724-4-1/4	374-43	H-14	1	34
J-1	JACK, telephone: 1-7/32"lg x 7/8"diam o/a; two solder lug terms; one spring contact 15/16" lg FMS; 1/4" diam plug hole; 3/8-32 mtg bushing .276" lg; nut and washer included; body 3/4" diam; no locating pin.	Connector for headphones		(type JK-34A)	Switchcraft Inc. No. C 11	389-48	J-1	1	35

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M-1	METER, counts per minute: 0-800 counts; round black plastic panel mtg case; 3.1"diam flange x 2.72"diam body x 1.06"d behind flange; black molded plastic case; D' Arsonval movement calibrated for non-magnetic panel; major scale: 0-800 counts per minute in 16 divisions; scale numbers and letters black; on white background; secondary scale: 0-.2 milliroentgens scale in 20 major divisions; scale numbers red on white background; 3-1/4" diam x 1-1/2"d o/a; has two No. 6-32 x 1/2" mtg ctrs.	Indicate intensity of radiation			Simpson Electric Co. Model 85	389-26	M-1	1	36
N-1	PLATE, identification: No. 24 gage aluminum; 2-1/2"lg x 1-3/8"w; two No.38 drill holes on 2-1/4" ctrs for mtg; border and letters polished aluminum on black background; inscribed-"Thyac, Survey Meter, Model 389, Serial--, The Victoreen Instrument Co. 5806 Hough Ave., Cleveland, Ohio".	Instrument Name plate			Victoreen Inst. Co. 389-77	389-77	N-1	1	37
O-1	SEAL, water: black rubber; 11/16"diam x 9/32"d o/a; 3/8-32 inside thd. 5/32"lg.	Range switch water sealnut			Radio Frequency Labs No. H1268	389-88	O-1	1	38

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O-2	SLEEVE, insulating: 1/32"thk laminated phenolic tubing; 1-19/64"lg x 1-3/16" OD x 1-1/8" ID; 9/32" wide axial slot.	Probe friction sleeve			Victoreen Inst. Co. 389-25	389-25	O-2	1	39
O-3	GASKET: aluminum, bright polish; roughly "I" shaped section 9-7/16"lg x 4-9/16"w x 1/2"d o/a; "I" section 3/8" across curved top, 1/2" across flat bottom x 1/4"d;	Metal gasket and trim between top & bottom case			Victoreen Inst. Co. 389-50	389-50	O-3	1	40
O-4	BUSHING: 18-8 stainless steel type 303; 39/64"lg x 9/16"diam o/a; curved hex head 1/2" across flats 5/64"lg; 3/8-32 outside thd 29/64"lg; .191" ID; 45° chamfer to 5/16" diam.	Case bushing for probe cable			Victoreen Inst. Co. 389-62	389-62	O-4	1	41
O-5	GASKET: case; rubber tubing 5/32"OD x 3/32"ID x 26-11/64"lg; 65 durometer.	Splashproof instrument case.			Philpott Rubber Co.	389-52	O-5	2	42
O-6	CLIP: fuse; phosphor bronze, nickel plated; "U" shaped; 9/16" lg x .385"w x 13/32"d o/a; mts by one .173 diam hole; clip has 9/32" diam curved section 3/8" from base.	Hold V-2 & V-3 in place			Littelfuse No. 104002	389-73	O-6	2	43
R-1	RESISTOR, fixed: composition; 10 megohms p/m 5%; 1/2w; temp char. F; .375"lg x .140"diam; insulated humidity resistant; two axial wire leads 1-1/2"lg.	V-2 grid bias voltage divider resistor	RC20BF106J	N16-R-51325-406	Allen Bradley EB 1065	185-304	R-1	1	44

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R-2	RESISTOR, fixed: composition; .18 megohms p/m5%; 1/2w; temp char. F; .375"lg x .140"diam; two axial wire leads 1-1/2"lg; insulated, humidity resistant.	Plate load resistor of V-2	RC20BF184J		Allen Bradley EB 1845	185-407	R-2	1	45
R-3	RESISTOR, fixed: composition; 10000 ohms p/m 10%; 1/2 w; temp char. F; .375"lg x .140" diam; insulated, humidity resistant; two axial wire leads 1-1/2"lg.	Plate load resistor of V-3	RC20BF103K		Allen Bradley EB 1031	185-253	R-3	1	46
R-4	RESISTOR, fixed: composition; .56 megohms p/m 10%; 1/2w; temp char. F; .375"lg x .140" diam; two axial wire leads 1-1/2"lg; insulated, humidity resistant.	Counter tube plate load resistor	RC20BF564K		Allen Bradley EB 5641	185-241	R-4	1	47
R-5	RESISTOR, fixed: composition; 1 megohm p/m 5%; 1/2w; temp. char. F; .375"lg x .140" diam; insulated, humidity resistant; two axial wire leads 1-1/2"lg.	Grid load resistor for V-2	RC20BF105J	N16-R-50974-404	Allen Bradley EB 1055	185-36	R-5	1	48
R-6	RESISTOR, fixed: composition; 33000 ohms p/m 5%; 1/2w; temp char. F; .375"lg x .140"diam; insulated, humidity resistant; two axial wire leads 1-1/2"lg.	Cathode bias resistor, V-2	RC20BF33J		Allen Bradley EB 3331	185-411	R-6	1	49

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R-7	RESISTOR, fixed: composition; .12 megohms p/m 5%; 1/2w; temp. char. F; .375"lg x .140" diam; two axial wire leads 1-1/2"lg; insulated, humidity resistant.	Grid load resistor of V-3	RC20BF124J		Allen Bradley EB 1245	185-409	R-7	1	50
R-8	RESISTOR, variable: composition; .25 megohm p/m 20%; 2w; 1-1/16" diam x 9/16"d less shaft and terms; 3 solder terms; 1/4" shaft 5/8"lg FMS; slotted locking shaft; 3/8-32 thd mtg bushing 1/2"lg FMS; two hex nuts & one washer included.	Calibrating potentiometer for time constant variation			Allen Bradley JLU 2541	389-63	R-8	1	51
R-9	RESISTOR, fixed: composition; 56000 ohms p/m 10%; 1/2w; temp. char. F; .375"lg x .140" diam; insulated humidity resistant; two axial wire leads 1-1/2"lg.	Audio circuit current limiting resistor	RC20BF563K		Allen Bradley EB 5631	185-363	R-9	1	52
S-1	SWITCH, rotary: four position, two section; shorting type; 1-3/4"lg x 1-5/16"diam o/a; solder type terms; 1/4"diam shaft 3/4" lg FMS, flatted to 3/16"thk x 5/16"lg; mts by 3/8-32 thd bushing 1/4"lg FMS; 30° angle of throw; contacts silver plated brass; 3/8-32 hex nut supplied.	Range switch			Oak Mfg. Co. Type F	389-67	S-1	1	53
V-1	TUBE, electron: RMA 1B85; counter tube.	Detector tube			Victoreen Inst. Co. 380-49	380-49	V-1	1	54
V-2 3	TUBE, electron: RMA 5828; medium mu triode.	Multi-vibrator			Victoreen Inst. Co. 5828	5828	V-2 3	2	55

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W-1	CABLE, coaxial: black rubber over shielding; 3/16"diam x 4 ft lg before coiling; 5/8"diam x 8" lg after coiling; ctr ends 2"lg min.	Probe cable			Victoreen Inst. Co. 389-9	389-9	W-1	1	56
X-1	SOCKET, tube: No. 13 gage stainless steel tubing, type 303; 1" OD x .815"ID x 1-5/8"lg o/a; 1"-20 thd 15/64"lg one end; 1/16"w slot 1-21/64" from internal thd end; 15/16-32 inside thd 11/64" lg other end; .896"ID x 9/16"lg section same end.	Socket for 1B85 counter tube			Victoreen Inst. Co. 389-23	389-23	X-1	1	57
BT-1	BATTERY, dry: 1.3 v; RM-4; 1.21" diam x .650"h o/a; case (+), one button term (-).	Filament supply for VX tubes			P.R.Mallory No. B-316-100	389-87	BT-1	1	58
BT-2	BATTERY, dry: 4.5 v; 4-3/32"lg x 3-15/16"w x 1-5/16"d o/a; one 1/8"diam & one 5/32"diam round pin term holes on .719" ctrs.	Input to Vibrator Power Supply			Eveready No. 736	389-59	BT-2	1	59
CR-1	CRYSTAL UNIT, rectifying: germanium diode; 1/2"lg x .205" diam wire leads 1"lg x .020" diam	Increases amplification, gives more linear response			G.E. 1N65	389-93	CR-1	1	60
HT-1	HEADSET: magnetic; 2500 ohms dc, res; single headset unit with 5' rubber jacketed cord and headband.	Aural indicator for counting gamma radiation.			Trimm Inc.	389-83	HT-1	1	61
MS-1	BAG: rubber; 1-1/16"diam x 2-1/32" lg o/a; major section 1-1/4"lg x 1-1/16"diam; neckdown section 3/8"OD x .183"ID x 3/4"lg one end; projection 1/2"OD x 3/8"ID x 3/32"lg other end with clamp.	Waterproof jack bag			Waterproof Elec. Co. NA-1000	389-36	MS-1	1	62

THE MODEL 389A THYAC

The Model 389A Thyac is essentially the same as the Model 389 and the information in this manual applies except for the changes outlined on this sheet.

1. The neon glow tube, NE 7, (See figure 2-4, Page 2-6.) functioning as the low voltage regulator is mounted on the control panel to form a pilot indicator instead of being mounted inside the power supply can. This pilot light, because of its primary function as a regulator, indicates that the batteries and power supply are delivering the correct operating voltages.
2. The Model 517A Vibrator Power Supply used with the Model 389A is a plug-in unit secured with a modified mounting bracket designed to facilitate replacement of the supply.
3. The Model 389A Thyac is tropicalized to prevent fungus growth in tropical climates.
4. The set of headphones is not supplied as standard equipment with the 389A Thyac.

5. PARTS LIST

The parts for the Models 389 and 389A are interchangeable except for the following:

a. The 389A uses top section 389-112 in place of part 389-71.

b. The 389A uses name plate (symbol N-1) 389-109 in place of part 389-77.

c. The 389A uses friction sleeve (symbol O-2) 389-98 in place of part 389-25.

d. The 389A uses coiled cord (symbol W-1) 389-16 in place of part 389-9.

e. The 389A uses Vibrator Power Supply 517-61 in place of part 517-5.

f. The 389A uses a 4700 ohm resistor (symbol R-3) 185-175 (Allen Bradley part EB 4721) in place of part 185-253.